

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Yoji Ito
Confirmation No.: 9994
Group Art Unit: 2871
Serial No.: 10/536,988
Examiner: Michael H. Caley
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For: LIQUID CRYSTAL DISPLAY OF OCB OR
VA MODE

DECLARATION PURSUANT TO RULE 132

Honorable Commissioner of Patents and Trademarks
Washington, D.C.

I, Yoji Ito, the above-named applicant, declare and state that:

I hereby submit experimental data obtained by experiments, which were recently performed by me.

Summary

In the following Experiment 1, I prepared a liquid crystal display of OCB mode in the same manner as in Example 1 given in my specification on pages 51-60. I measured the distance between the color filter and the light-diffusing layer of the viewer-side polarizing plate (that is the total thickness of the viewer-side substrate, the optically anisotropic layer of the viewer-side polarizing plate, the first transparent protective film of the viewer-side polarizing plate, the polarizing membrane of the viewer-side polarizing plate and the second transparent protective film of the viewer-side polarizing plate).

In the following Experiment 2, I prepared a liquid crystal display of OCB mode in the same manner as in the Experiment 1, except that the first and second

transparent protective films were modified described below. I measured the distance between the color filter and the light-diffusing layer of the viewer-side polarizing plate.

Experiment 1

A liquid crystal display of OCB mode was prepared in the same manner as in Example 1 given in my specification on pages 51-60. I measured the distance between the color filter and the light-diffusing layer of the viewer-side polarizing plate. The distance was 0.593 mm.

Experiment 2

(Preparation of cellulose acetate film used as the first transparent protective film)

A cellulose acetate solution and a retardation increasing agent solution were prepared in the same manner as in Example 1 given in my specification on pages 51-52.

The cellulose acetate solution (458 weight parts) and the retardation-increasing agent solution (42 weight parts) were mixed and stirred well to prepare a dope. The prepared dope contained the retardation-increasing agent in the amount of 9.2 weight parts based on 100 weight parts of cellulose acetate.

The dope was cast on a band by means of a band-casting machine. After the surface temperature of the dope on the band reached at 35°C, the dope was dried for 1 minute. When the solvent remaining in the formed dope film reached 45 wt.%, the film was peeled from the band. The film was conveyed to a tenter-stretching zone, where it laterally stretched by 40% with a tenter at 140°C. The stretched film was then dried at 140°C for 10 minutes, and further dried at 130°C for 20 minutes. Thus, a cellulose acetate film (thickness: 40 μ m) containing the remaining solvent in the amount of 0.1 wt.% was prepared.

The optical characters of the prepared cellulose acetate film were measured at the wavelength of 550 nm by

means of an ellipsometer (M-150, JASCO COORPORATION), and thereby it was found that the R_e and R_{th} values were 55 nm and 130 nm, respectively.

The surface of the prepared cellulose acetate film was treated in the same manner as in Example 1 in my specification on page 53.

Thus, a cellulose acetate film used as the first transparent protective film was produced.

(Formation of orientation layer)

An orientation layer was formed on the first transparent protective film in the same manner as in Example 1 in my specification on pages 53-54.

(Formation of optically anisotropic layer)

In 102 g of methyl ethyl ketone, 41.01 g of the discotic liquid crystal compound given in my specification on page 55, 4.06 g of ethylene oxide denatured trimethylolpropanetriacrylate (V#360, Osaka Organic Chemicals Co., Ltd.), 1.36 g of cellulose acetate butyrate (CAB-551-0.2, Eastman Chemical), 1.35 g of a photopolymerization initiator (Irgacure 907, Ciba-Geigy) and 0.45 g of a sensitizer (Kayacure DETX, Nippon Kayaku Co., Ltd.) were dissolved to prepare a coating solution. The coating solution was applied on the orientation layer by means of a wire bar coater of #4, and then heated in a thermostat zone at 130°C for 2 minutes to orient the molecules of the discotic compound in hybrid alignment. The film was irradiated at 100°C for 0.4 second with ultraviolet rays emitted from a high-pressure mercury lamp of 1200 W/cm, to polymerize and fix the molecules of the discotic compound. Thus, an optically anisotropic layer was formed.

The R_e retardation value of the formed optically anisotropic layer was measured at 550 nm, to find 45 nm. The average angle (inclined angle) between the discotic planes and the cellulose acetate film surface was found 40°.

(Preparation of cellulose acetate film used as the second transparent protective film)

Cellulose acetate solutions used as dopes for forming inner and outer (surface) layers were prepared in the same manner as in Example 1 given in my specification on pages 55-56.

The obtained dope for outer layer was filtered at 50°C through a filter paper (absolute filtration precision: 0.0025 mm, FH025 PALL CORPORATION). The dope for inner layer was filtered at 50°C through another filter paper (absolute filtration precision: 0.01 mm, #63 TOYO ROSHI KAISHA LTD.).

The dopes were cooperatively cast on a metal support from a three-layer co-casting die, so that the dope for inner layer might be sandwiched with the dope for outer layer and also so that the dry thickness of the inner and outer layers might be 40 µm and 5 µm, respectively.

After stepwise dried on the support at 70°C for 3 minutes and at 140°C for 5 minutes, the formed film was peeled from the support. The peeled film was further dried at 130°C for 30 minutes to evaporate the solvent. The amount of the solvent remaining in the film was 20 wt.% when the film was peeled from the support, while that was 0.4 wt.% when all the procedures were completed.

The peeled film was uniaxially stretched by 10% in the lateral direction by means of a tenter, and further uniaxially stretched by 15% in the longitudinal direction between rolls. The surfaces of the rolls for stretching were beforehand polished to be mirrors. Heated oil was circulated to control the temperature of the rolls at 135°C while the film was stretched. After stretched, the film was dried and wound up at 130°C for 30 minutes. The thickness of the resultant film was 40 µm.

The surface roughness (Ra) of the film per 100 mm was measured at ten points randomly selected in the lateral direction, to find 0.06 µm on average.

Thus, the cellulose acetate film used as the second transparent protective film was produced.

(Formation of light-diffusing layer)

A light-diffusing layer was prepared in the same manner as in Example 1 given in my specification on pages 57-58.

The haze of the second transparent protective film on which the diffusing layer was provided was determined by means of a measuring apparatus (HR-100, Murakami Shikisai Gijutsu-kenkyujo Co., Ltd,) according to JIS-K-7105, to be found 56%.

(Production of viewer-side polarizing plate for OCB mode)

A viewer-side polarizing plate for OCB mode was produced in the same manner as in Example 1 given in my specification on page 58.

(Production of backlight-side polarizing plate)

A backlight-side polarizing plate was produced in the same manner as in Example 1 given in my specification on page 59.

(Production of liquid crystal display of OCB mode)

On a glass plate provided with an ITO electrode, a polyimide layer was formed and the surface of the layer was subjected to rubbing treatment to form an orientation layer. Further, another glass substrate having orientation layer was prepared in the same manner. The thus-prepared two glass plates were faced to each other so that the rubbing directions were parallel to each other, and combined so that the gap between the plates might be 6 μm . A commercially available liquid crystal compound ($\Delta n = 0.1396$; trade name: ZLI1132, Merck & Co., Inc.) was inserted into the gap, to prepare a liquid crystal cell of OCB mode.

On one side of the prepared liquid crystal cell, the viewer-side polarizing plate was laminated. On the other

side, the backlight-side polarizing plate was laminated. The viewer-side polarizing plate was placed so that the optically anisotropic layer might be contact with the cell and so that the rubbing direction of the anisotropic layer might be anti-parallel to that of the liquid crystal cell. On the backlight-side polarizing plate, a backlight unit was provided.

In the thus-assembled composition, the distance between the color filter and the light-diffusing layer was 0.563 mm.

Voltage of a square wave (55 Hz) was applied to the liquid crystal cell. An image was displayed according to normally white mode (white: 2V, black: 5V). A ratio of contrast (white/black) was measured by means of a meter (EZ-Contrast 160D, ELDIM) at eight displaying states of L1 (full black) to L8 (full white).

The viewing angle was evaluated as an angle range giving a contrast ratio of 10 or more without reversing black tones (between L1 and L2). As a result, it was found that the angle was 80° in each of the upward, downward and right-leftward directions.

The undersigned declarant declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date August 10, 2007


YOJI ITO